

What is claimed is.

[1] A treatment process of a solution containing an organic compound having a fluorocarbon chain (hereinafter said to as the fluorine compound), the process comprising,  
adding divalent and trivalent metal salts to said solution,  
forming a layered double hydroxide having the fluorine compound between layers to absorb and fix the fluorine compound.

[2] A treatment process of a solution containing the fluorine compound, the process comprising,  
adding divalent and trivalent metal salts to said solution,  
precipitating a layered double hydroxide having the fluorine compound between layers,  
separating a solid part by the solid-liquid separation,  
dissolving said separated solid part in an acid, and  
separating the fluorine compound or its salt.

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[3] The treatment process of the solution containing the fluorine compound according to claims [1] or [2], the process further comprising,  
adjusting pH of the solution to more than 4,  
precipitating the layered double hydroxide having the fluorine compound between layers.

[4] The treatment process of the solution containing the fluorine compound according to claims [1] or [2], the process further comprising,  
adding an alkali to the solution to adjust pH from 4 to 12,  
adding divalent and trivalent metal salts to said solution  
precipitating the layered double hydroxide having the fluorine compound

between layers.

[5] The treatment process of the solution containing the fluorine compound according to any one of claims [1] to [4],

wherein the divalent metal salt is a salt of magnesium, calcium, zinc, nickel, copper, manganese (divalent), or cobalt (divalent), and the trivalent metal salt is a salt of aluminum, iron, chromium, manganese (trivalent), cobalt (trivalent), potassium, lanthanum, or scandium.

[6] The treatment process of the solution containing the fluorine compound according to any one of claims [1] to [5],

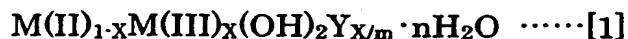
wherein the divalent and the trivalent metal salts are chlorides.

[7] The treatment process of the solution containing the fluorine compound according to any one of claims [1] to [6],

wherein the fluorine compound is carboxylic acid or sulfonic acid having the fluorocarbon chain, in which the number of carbon is more than 5.

[8] The treatment process of the solution containing the fluorine compound according to any one of claims [1] to [7],

wherein the layered double hydroxide having the fluorine compound between layers is shown in the following formula [1].



where, Y is an anion having valence number m of the fluorine compound having the fluorocarbon chain, M(II) is a divalent metal ion, M(III) is a trivalent metal ion, X is 0.1 to 0.5, and n is 0 or positive integer.

[9] A treatment process for recovering the fluorine compound and its salts, the process comprising,

precipitating the layered double hydroxide by the treatment process

according to any one of claims [1] to [7],  
recovering the solid part by the solid-liquid separation,  
dissolving said recovered solid part in a mineral acid to recover the  
separated fluorine compound or its salts, or  
heating said mineral acid dissolving the recovered solid part,  
putting quietly to separate an oil layer, and  
taking out the oil layer to recover the fluorine compound and its salts.

[10] A treatment process for recovering a fluorine compound and its  
salts, the process comprising,  
precipitating the layered double hydroxide by the treatment process  
according to any one of claims [1] to [7],  
recovering the solid part by the solid-liquid separation,  
dispersing the recovered solid part to an organic solvent, and  
filtering an insoluble part from said solvent.

[11] A layered double hydroxide shown by above-mentioned formula  
[1], which contains the fluorine compound between layers and is formed by  
adding the divalent and trivalent metal salts to the solution containing the  
fluorine compound having the fluorocarbon chain.

## Summary

Divalent and trivalent metal salts are added to the solution containing the fluorine compound to precipitate the layered double hydroxide containing the fluorine compound between layers. By these processes, the fluorine compound can be fixed with high rate. Moreover, if necessary, the precipitated layered double hydroxide can be recovered to separate the fluorine compound or its salt between layers. Therefore, the burden to environment or the ecosystem by the fluorine compound can be reduced.

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Table 1

No.	Fluorine Compound Solution			Additional Metal Salt		Solution pH	Precipitate		
	Kinds	Concentration, Amount	Amount of Anion	Divalent	Trivalent		Amount	Anion Concentration	Anion Fixing Ratio
1	Per-fluoro-octanoic acid ammonium ( $C_7F_{15}COONH_4$ )	Aqueous solution of 0.1%, 1000ml	2.32mmol	Zn 4.64mmol	Al 2.32mmol	7	1.50 g	2.23mmol	96.1%
2	Ditto	Aqueous solution of 0.1%, 100ml	2.32mmol	Zn: 4.64mmol	Al: 2.32mmol	7	1.50 g	2.3mmol	99.1%
		Aqueous solution of 0.01%, 1000ml	0.232mmol	Zn: 0.464mmol	Al: 0.232mmol		0.15 g	0.21mmol	91.0%
3	Ditto	Aqueous solution of 0.1%, 1000ml	2.32mmol	Zn 4.64mmol	Al 2.32mmol	5	1.50 g	2.27mmol	98%
4	Ditto	Aqueous solution of 0.1%, 1000ml	2.32mmol	Mg 4.64mmol	Al 2.32mmol	10	1.10 g	1.4mmol	80%
5	Ditto	Aqueous solution of 0.1%, 1000ml	2.32mmol	Ca 4.64mmol	Al 2.32mmol	10	0.85 g	2.3mmol	60%
6	Per-fluoro-octyl-sulfonic acid ammonium ( $C_8F_{17}SO_3NH_4$ )	Aqueous solution of 0.1%, 1200ml	2.32mmol	Zn 4.64mmol	Al 2.32mmol	7	1.70 g	2.23mmol	99%
7	Per-fluoro-octyl-sulfonic acid lithium ( $C_8F_{17}SO_3Li$ )	Aqueous solution of 0.1%, 1174ml	2.32mmol	Zn 4.64mmol	Al 2.32mmol	7	1.65 g	2.21mmol	95%
10	Per-fluoro-decanoic acid ammonium ( $C_9F_{19}COONH_4$ )	Aqueous solution of 0.005%, 1000ml	1.161mmol	Zn 2.32mmol	Al 1.16mmol	7	0.84 g	1.09mmol	94%

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